

# ASSIGNMENT 1

Textbook Assignment: Unit 1, Lesson 1, "The Sea Surface". Pages 1-1-1 through 1-1-17.  
Unit 1, Lesson 2, "The Ocean Body". Pages 1-2-1 through 1-2-7.

Learning Objective:  
Recognize the difference  
between wind waves, swell  
waves, combined waves, and  
rogue (or freak) waves.

- A. ROGUE
- B. SEAS
- C. SWELLS
- D. COMBINED

FIGURE 1A

IN ANSWERING QUESTIONS 1-1 THROUGH 1-4,  
SELECT THE TYPE OF WAVE FROM FIGURE 1A  
THAT MOST CLOSELY FITS THE DEFINITION  
GIVEN. RESPONSES ARE USED ONLY ONCE.

1-1. Waves that result when wind waves  
move out of the fetch area.

- 1. A
- 2. B
- 3. C
- 4. D

1-2. Rare waves normally encountered  
near areas of strong ocean  
temperature gradients.

- 1. A
- 2. B
- 3. C
- 4. D

1-3. Waves formed by the frictional  
force of the wind on the water  
surface.

- 1. A
- 2. B
- 3. C
- 4. D

1-4. Waves produced when waves, coming  
from different directions, interact  
with each other.

- 1. A
- 2. B
- 3. C
- 4. D

- A. AVERAGE WAVE HEIGHT
- B. FETCH LIMITED SEA
- C. DURATION LIMITED SEA
- D. SIGNIFICANT WAVE HEIGHT

Figure 1B

IN ANSWERING QUESTIONS 1-5 THROUGH 1-8,  
SELECT THE RESPONSE FROM FIGURE 1B THAT  
MOST CLOSELY FITS THE DESCRIPTION GIVEN.  
RESPONSES ARE USED ONLY ONCE.

1-5. The average height of the highest  
1/3 of the waves produced in a  
fetch area.

- 1. A
- 2. B
- 3. C
- 4. D

1-6. The average height of all the waves  
produced in a fetch area.

- 1. A
- 2. B
- 3. C
- 4. D

1-7. Waves that are not as developed as  
the wind speed indicates because  
the length of time the wind has  
been blowing is too short.

- 1. A
- 2. B
- 3. C
- 4. D

- 1-8. Waves that are not as developed as the wind speed indicates because the fetch area is too short.
1. A
  2. B
  3. C
  4. D

- 1-9. Which of the following statements is NOT true concerning swell waves?

1. Swell waves can form when wind waves move out of the generating fetch area
2. Swell waves may form when winds over a fetch area die
3. Wind waves transform to swell waves because of friction and other forces acting against the wave
4. As swell waves propagate, the wave height increases as the wave period increases

- 1-10. What is the combined sea height if an area has 4-foot seas and 6-foot swells?

1. 52 ft
2. 10 ft
3. 7 ft
4. 6 ft

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Learning Objective: Define surf, and recognize the factors that affect it.

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- 1-11. What definition of surf is used in the training manual?

1. Swell that breaks upon the shore
2. Waves that alter their characteristics as they "feel bottom"
3. The near shore circulation of water from the beach to the deeper water, and back to the beach

- 1-12. If a wave with a wavelength of 50 feet is approaching shallower water, the wave wave begin to "feel bottom" when the water depth is about how many feet?

1. 150 ft
2. 50 ft
3. 25 ft
4. 16 ft

- 1-13. As a wave begins to "feel bottom", what changes will take place?

1. The wave length stays the same but the height increases, making the wave become steeper
2. The wave length decreases while the height stays the same, making the wave become steeper
3. The wave length and the steepness remain the same; only the height increases due to the buildup on water
4. The wave length decreases while the steepness increases

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Learning Objective:  
Recognize and explain the nearshore circulation system.

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- 1-14. The movement of water near a shoreline is accomplished by what two circulation systems?

1. Nearshore and tidal
2. Tidal and littoral
3. Nearshore and coastal
4. Littoral and rip

- 1-15. Which of the following nearshore circulation system mechanisms moves water generally parallel to the beach?

1. Rip current
2. Wave action near the surface of the water
3. Wave action near the bottom
4. Littoral current

- 1-16. What causes littoral currents?
1. A buildup of water due to tidal action
  2. The frictional effect of wind on the water
  3. Waves approaching the beach at an angle that causes a net movement of water
  4. The net movement of water due to the rotation of the Earth

- 1-17. Which of the following characteristics causes the longshore current to become stronger?
1. Decreasing surf height
  2. Decreasing wave period
  3. Decreasing breaker angle (breakers become more parallel to beach)
  4. Decreasing beach slope

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Learning Objective:  
Identify the major ocean currents and their locations, and recognize their effects on the weather.

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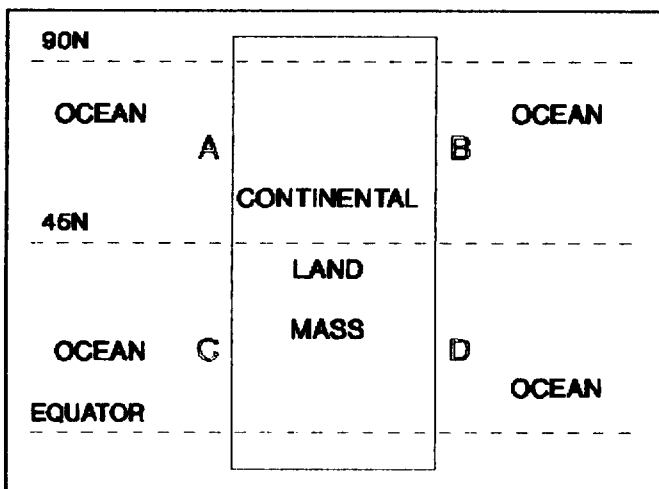


Figure 1C

- 1-18. Which areas in figure 1C would likely experience a warm current?
1. **A and D**
  2. **B and C**
  3. **A and B**
  4. **C and D**

- 1-19. In which areas will the current flow equatorward?

1. **A and B**
2. **B and C**
3. **C and D**
4. **A and D**

- 1-20. Which warm current of the North Atlantic begins near Cape Hatteras and continues to the vicinity of the Grand Banks?

1. Gulf Stream Current
2. Gulf Stream System
3. Hatteras Current
4. North Atlantic Current

- 1-21. Which warm current is fed by the Antilles Current?

1. Gulf Stream Current
2. Florida Current
3. Canaries Current
4. North Equatorial Current

- 1-22. Which currents are part of the North Atlantic Current?

1. Gulf Stream and North Equatorial
2. Canaries and Norwegian
3. Antilles and North Equatorial
4. Irminger and Antilles

- 1-23. The Gulf Stream System is made up of the Gulf Stream Current and what two other currents?

1. Antilles and Florida
2. North Equatorial and Antilles
3. North Atlantic and Canaries
4. North Atlantic and Florida

IN ANSWERING QUESTIONS 1-18 AND 1-19, REFER TO FIGURE 1C AND THE TEXT ON PAGE 1-1-6. FIGURE 1C REPRESENTS A NORTHERN HEMISPHERE CONTINENT.

- 1-24. In the North Pacific, what is the swift, narrow subsurface counter-current near the Equator from 140°W to 92°W?
1. California Current
  2. Equatorial Counter-current
  3. Cromwell Current
  4. North Pacific Current
- 1-25. What is the warm current in the western Pacific that corresponds to the Gulf Stream Current of the Atlantic?
1. North Pacific Current
  2. North Equatorial Current
  3. Cromwell Current
  4. Kuroshio Current
- 1-26. What is the only current that completely encircles a continent?
1. North Equatorial Current
  2. Falkland Current
  3. Kuroshio System
  4. West Wind Drift Current
- 1-27. What current produces cool summers for the west coast of the United States?
1. Cromwell Current
  2. Oyashio Current
  3. Davidson Current
  4. California Current
- 1-28. Ireland and the west coast of Scotland experience cool rainy winters although they are at about the same latitude as the province of Labrador in eastern Canada. Labrador is known for very cold, snowy winters. Which of the following currents is a primary factor causing the warmer winter weather in Ireland?
1. Labrador Current
  2. Greenland Current
  3. Norwegian Current
  4. North Atlantic Current
- 1-29. Which of the following is a cold current along the African coast that produces coastal fog and arid conditions inland?
1. North Equatorial Current of the Indian Ocean
  2. Canaries Current
  3. Mozambique Current
  4. Agulhas Stream
- 1-30. What low-latitude current produces a warm and rainy climate in the Caribbean?
1. North Equatorial Current
  2. Davidson Current
  3. Oyashio Current
  4. Benguela Current

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Learning Objective:  
Describe the formation of ice on the surface of the sea, and differentiate between sea ice and land ice.

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1-31. In the open ocean, at what water temperature does the water begin to freeze?

1. -2.4°C
2. -1.9°C
3. -0.4°C
4. 0.0°C

1-32. In the open sea, what is the first sign that the water is beginning to freeze?

1. The water appears "oily"
2. Thin brittle flakes of ice form on the surface
3. Pancakes of ice are observed
4. Icebergs begin moving into the area

1-33. What is "fast ice"?

1. Unbroken ice frozen in place along shorelines or bridging land masses
2. Ice which moves rapidly with the current
3. Ice which, due to its density, forms and sinks out of sight
4. Small crystals of ice which form rapidly in the sea

1-34. A saltwater bay has a salinity of 11 ‰. At what water temperature will the bay begin to freeze?

1. +0.8°C
2. -0.0°C
3. -0.8°C
4. -1.9°C

1-35. Ice RECON personnel surveyed the Point Barrow, Alaska area four days ago and reported "young first-year ice" out to 120 nmi. What is the thickness of the ice?

1. Less than 10 cm
2. More than 10 cm but less than 30 cm
3. More than 30 cm but less than 1.22 meter
4. More than 1.22 meter but less than 2.0 meter

**A. TABULAR BERG**  
**B. FLOE**  
**C. BERGY BIT**  
**D. GROWLER**

FIGURE 1D

IN ANSWERING QUESTIONS 1-36 THROUGH 1-39, SELECT THE TERM FROM FIGURE 1D THAT BEST FITS THE DEFINITION GIVEN. TERMS ARE USED ONLY ONCE.

1-36. Irregular glacial ice, with a greenish color about the size of a grand piano.

1. A
2. B
3. C
4. D

1-37. Irregular glacial ice fragment about the size of a small house.

1. A
2. B
3. C
4. D

1-38. Generally flat-topped, vertical-sided, glacial-ice fragment.

1. A
2. B
3. C
4. D

1-39. Generally flat-topped, vertical-sided, sea-ice fragment.

1. A
2. B
3. C
4. D

1-40. Numerous saltwater ice fragments, each about the size of a volleyball court, have been pushed up on the beach near Adak NAS. What term is used to describe this ice?

1. Small floes
2. Bergy bits
3. Ice cakes
4. Fast ice

- 1-41. Antarctica's Ross Ice Shelf covers many hundreds of square miles of the Ross Sea. This permanent ice extends over 400 nmi seaward from the coastline as a continuous sheet across the Ross Sea and, in many places, is indistinguishable from the ice sheet covering the land areas. What term, other than "ice shelf", may be used to describe this area of mixed multi-year ice and snow deposits?
1. Giant floe
  2. Glacier
  3. Frozen continent
  4. Fast ice
- 1-42. What is the term used to describe a fragment of saltwater ice that measures 3 km across?
1. Giant floe
  2. Vast floe
  3. Big floe
  4. Medium floe
- 1-43. What is the term used to describe a fragment of sea ice that measures 300 meters across?
1. Giant floe
  2. Vast floe
  3. Big floe
  4. Medium floe
- 1-44. What is the term used to describe a fragment of sea ice that measures 3 meters across?
1. Medium floe
  2. Vast floe
  3. Big floe
  4. Small ice cake
- 1-45. Ice floes sometimes fracture, get pushed together, and override other ice floes. If we ignore age and weathering, what is/are the correct term(s) for this type of topographical feature?
1. Rafted ice
  2. Ridged ice
  3. Hummocked ice
  4. All of the above
- 1-46. One of SUBLANTS Boomers has surfaced in the Arctic in a large open-water area. They report rough rafted ice and fast ice completely surrounding their submarine. In what type of feature have they surfaced?
1. Polynya
  2. Thaw hole
  3. Puddle
  4. Lead
- 1-47. A large piece of ice breaks off the permanent Ronne Ice Shelf in Antarctica's Weddell Sea. Like the Ross Ice Shelf, this shelf is composed of mixed multi-year ice and compacted snow. If this flat-topped piece of ice measures over 2 kilometers across, which of the following terms could be used to describe it?
1. Irregular iceberg
  2. Glacial iceberg
  3. Tabular iceberg
  4. Pinnacled iceberg
- 1-48. In what location are most of the world's icebergs formed?
1. The Antarctic
  2. The Arctic
  3. Greenland
  4. Alaska
- 1-49. Which of the following statements about the movement of Pack Ice is correct?
1. It moves parallel to the sea-level pressure isobars at 1.4 to 2.4 percent of the prevailing wind speed
  2. It moves with the wind (opposite the wind direction) at 1.4 to 2.4 percent of the wind speed
  3. It moves in the direction of the prevailing water current at the speed of the water current
  4. It does not move, since it is a solid mass and locked in place

1-50. Which of the following statements about the movement of icebergs is correct?

1. Movement depends on the size and shape of the berg above the water, because it moves mostly under the influence of the wind.
2. Movement depends on the size and shape of the berg below the water, because it moves mostly under the influence of the water currents.
3. Movement depends on the size and shape of the berg both above and below the water, because it moves under a combined influence of the wind and currents.
4. Movement depends only on the winds and the water currents -- the size and shape of the berg contribute little to the movement since the winds and water circulate freely around the berg

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Learning Objective: Identify the ocean's heat source, the normal range of temperatures within the ocean, and the factors that control the distribution of heat within the oceans.

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1-51. What is the normal temperature range in the open ocean?

1. -2°C to 30°C
2. -2°C to 20°C
3. 0°C to 30°C
4. 0°C to 100°C

1-52. What is the normal deep-ocean temperature range?

1. -2°C to 4°C
2. -1°C to 14°C
3. 1°C to 4°C
4. 0°C to 14°C

1-53. What is the average daily variation in the sea surface temperature?

1. 2 to 3°C
2. 2 to 3°F
3. 0.2 to 0.3°C
4. 0.2 to 0.3°F

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Learning Objective: Define salinity, pressure, density, compressibility, viscosity, and specific heat, and recognize how these properties of the ocean affect sound velocity and sound refraction within the ocean.

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1-54. With respect to interpretation of oceanographic conditions affecting antisubmarine warfare, what are the three most important properties of seawater?

1. Temperature, pressure, and density
2. Temperature, pressure, and salinity
3. Density, salinity, and sound velocity
4. Temperature, salinity, and sound velocity

1-55. Regarding water salinity measurements, the symbol ‰ or ‰ represents

1. grams of dissolved material per kilogram of water
2. parts per thousand by volume
3. grams of salt per kilogram of water
4. percent by weight

1-56. In the open ocean, what salinity values would be reasonable for (a) an average area, (b) an area with a high evaporation rate, and (c) an area with a high precipitation amount?

1. (a) 33‰ (b) 35‰ (c) 27‰
2. (a) 35‰ (b) 40‰ (c) 33‰
3. (a) 35‰ (b) 37‰ (c) 27‰
4. (a) 35‰ (b) 37‰ (c) 33‰

- 1-57. In the open ocean, where do maximum salinity values usually occur?
1. 20° to 23° north and south of the equator
  2. At the equator
  3. Near the poles
  4. Near the mouths of large rivers
- 1-58. Lower salinity values are usually found near the equator because
1. large amounts of precipitation (associated with the Inter-Tropical Convergence Zone) dilute the water
  2. strong, steady winds of the Easterlies increase evaporation
  3. greater heating increases evaporation
  4. the strong, steady Easterlies produce upwelling of lower salinity deep ocean water
- 1-59. Which of the following areas would have a lower than average salinity value?
1. Areas with ice forming
  2. Coastal water area with continental polar air masses moving over it
  3. Coastal area near a river mouth
  4. Areas with high evaporation rates
- 1-60. What happens when strong cold air advection occurs over an ocean area?
1. Temperature and salinity increase
  2. Temperature and salinity decrease
  3. Temperature decreases and salinity increases
  4. Temperature increases and salinity decreases
- 1-61. What, if anything, happens to a parcel of ocean surface water when its density increases?
1. It sinks to a level of equal density
  2. It rises to a level of equal density
  3. Nothing; the entire layer which contains the parcel also increases density
- 1-62. At a constant depth, which of the following processes will cause density to increase the most?
1. A decrease in both temperature and salinity
  2. A decrease in temperature and an increase in salinity
  3. An increase in both temperature and salinity
  4. An increase in temperature and a decrease in salinity
- 1-63. At an equal pressure and 35 ‰ salinity, at which of the following temperatures would a parcel of seawater be the most dense?
1. -10.0°C
  2. - 1.0°C
  3. - 1.9°C
  4. 10.0°C
- 1-64. What factor affects sound velocity (and water density) the most?
1. Temperature
  2. Salinity
  3. Pressure
  4. The biological seawater population

1-65. Which of the following statements about sound velocity in seawater is correct?

1. The speed of sound increases with decreasing density
2. Sound waves are refracted toward water of greater density
3. Sound waves are refracted toward water with a slower sound speed
4. Sound waves are refracted toward water with a lower temperature

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Learning Objective:  
Identify the layers of the 3-layer ocean model, and differentiate between mechanical and convective mixing.

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1-66. Which of the following correctly lists the layers of the 3-layer ocean model?

1. Mixed layer, main thermocline, deep water layer
2. Surface layer, mixed layer, main thermocline
3. Surface layer, mixed layer, deep water layer
4. Surface layer, main thermocline, mixed layer

1-67. What is the maximum depth of the mixed layer?

1. 100 feet/30 meters
2. 500 feet/150 meters
3. 1,000 feet/300 meters
4. 1,500 feet/450 meters

1-68. Which of the following processes causes mechanical mixing in the mixed layer?

1. Wave action
2. Evaporation
3. Ice formation
4. Surface cooling

1-69. Which of the following conditions is likely to cause the greatest change in the depth of the mixed layer in the North Atlantic during winter?

1. Cold, dry air advection
2. Warm, moist air advection
3. Increasing winds/seas
4. Cold, moist air advection

1-70. Which of the following statements is correct concerning water temperature through the mixed layer?

1. Temperatures are generally isothermal through the mixed layer
2. The depth of the bottom of the mixed layer is known as the mixed layer depth (MLD)
3. The mixed layer depth is generally deepest in the mid-latitudes, shallower in the low latitudes, and nonexistent or very close to the surface in the high latitudes
4. Each of the above

1-71. What is the basic characteristic of the Main Thermocline?

1. It lies below a layer of increasing temperatures with depth
2. It is marked by a rapid decrease in temperature with increasing depth
3. It is marked by a rapid increase in temperature with increasing depth
4. The speed of sound decreases with increasing depth

- 1-72. Which of the following statements is **NOT** true concerning the mixing processes that affect the Mixed Layer Depth?
1. The wave height directly affects the depth of mechanical mixing, but may not affect mixing as deep as convective mixing
  2. Convective mixing occurs when surface waters are cooled or when surface water salinity increases; it can cause mixing to a greater depth than mechanical mixing
  3. Convective mixing occurs when surface water is warmed or cooled, or when salinity either increases or decreases
  4. Convective mixing and mechanical mixing acting together normally cause mixing to a greater depth than either process acting by itself (a synergistic process)

- 1-73. Which of the following statements about the Seasonal Thermocline is true?
1. It forms at a shallower depth than the Main Thermocline
  2. In the Northern Hemisphere it is normally observable from Spring through Autumn
  3. During the wanner seasons both a Seasonal Thermocline and the Main Thermocline can be observed on a bathythermograph trace
  4. Each of the above

- 1-74. During which season is the Seasonal Thermocline normally most developed?

1. Winter
2. Spring
3. Summer
4. Autumn

- 1-75. During which season should you normally expect to observe only the Main Thermocline?

1. Winter
2. Spring
3. Summer
4. Autumn